Interrupt Vector Table

Interrupt Vector Table (IVT)

IVT is a structured list containing the addresses of Interrupt Service Routine (ISR) for various interrupts. It is also known as Interrupt Pointer Table (IPT).

INT N,   N = Type Number = 0 to 255 ⮕ 256 Software Interrupts

IVT should have the addresses of ISR for 256 interrupts.

Physical Address = Code Segment and Instruction Pointer = CS X 10H + IP = 20 bits in size.

CS = 2 bytes and IP = 2 bytes.

So there is unique 256 interrupts ISR addresses.

256 interrupts = 256 X 4 = 1024 bytes = 1KB is located in the starting part of memory.

Address range will be CS : IP = 0000 : 0000 to 0000 : 03FFH

Interrupt Vector Table (IVT)

CS : IP	Physical Address	Memory
0000 : 0000	00000	1 byte size
0000 : 0001	00001	1 byte size
0000 : 0002	00002	1 byte size
0000 : 0003	00003	1 byte size
0000 : 0004	00004	1 byte size
0000 : 0005	00005	1 byte size
0000 : 0006	00006	1 byte size
0000 : 0007	00007	1 byte size
0000 : 0008	00008	1 byte size
0000 : 0009	00009	1 byte size
0000 : 000A	0000A	1 byte size

Interrupt Vector Table (IVT)

CS : IP	Physical Address	Memory
....	....	....
0000 : 03F6	003F6	1 byte size
0000 : 03F7	003F7	1 byte size
0000 : 03F8	003F8	1 byte size
0000 : 03F9	003F9	1 byte size
0000 : 03FA	003FA	1 byte size
0000 : 03FB	003FB	1 byte size
0000 : 03FC	003FC	1 byte size
0000 : 03FD	003FD	1 byte size
0000 : 03FE	003FE	1 byte size
0000 : 03FF	003FF	1 byte size

For any interrupt to be pointed to an ISR we need 4 bytes.

Type number = 0 to 255

Type 0 interrupt (Divide by 0)

To execute Type 0 interrupt in needs to go to the specific ISR.

Higher memory address contains higher byte and lower memory address contains lower byte.

IP for the ISR of Type N = 4N (Where, N is Type number)

CS for the ISR of Type N = 4N+2 (Where, N is Type number)

For Type 1, IP = 4X1 = 00004H and CS = 4X1+2 = 00006H.

CS : IP	Physical Address	Memory
0000 : 0000	00000	IP (Lower byte) for Type 0
0000 : 0001	00001	IP (Higher byte) for Type 0
0000 : 0002	00002	CS (Lower byte) for Type 0
0000 : 0003	00003	CS (Higher byte) for Type 0
0000 : 0004	00004	IP (Lower byte) for Type 1
0000 : 0005	00005	IP (Higher byte) for Type 1
0000 : 0006	00006	CS (Lower byte) for Type 1
0000 : 0007	00007	CS (Higher byte) for Type 1
0000 : 0008	00008	………
0000 : 0009	00009	………
0000 : 000A	0000A	………

CS : IP	Physical Address	Memory
....	....	....
0000 : 03F6	003F6	....
0000 : 03F7	003F7	....
0000 : 03F8	003F8	IP (Lower byte) for Type 254
0000 : 03F9	003F9	IP (Higher byte) for Type 254
0000 : 03FA	003FA	CS (Lower byte) for Type 254
0000 : 03FB	003FB	CS (Higher byte) for Type 254
0000 : 03FC	003FC	IP (Lower byte) for Type 255
0000 : 03FD	003FD	IP (Higher byte) for Type 255
0000 : 03FE	003FE	CS (Lower byte) for Type 255
0000 : 03FF	003FF	CS (Higher byte) for Type 255

Example: Determine the physical address of the ISR for the given IVT if Type 0 interrupt is encountered by 8086 microprocessor.

CS : IP	Physical Address	Memory
0000 : 0000	00000	05H
0000 : 0001	00001	34H
0000 : 0002	00002	00H
0000 : 0003	00003	20H
………	………	………
………	………	………
………	………	………
2000 : 3405	23405	MOV AX, BX (in Hex Code)
2000 : 3406	23406	………
2000 : 3407	23407	………
2000 : 3408	23408	………

Solution:

Type 0, N = 0

IP = 4N = 4X0 = 00000H (Address of the ISR IP)

IP is stored at this address. This is not the value of the IP, it is the value at which the IP of the ISR will be located.

CS = 4N+2 = 4X0+2 = 00002H (Address of the ISR CS)

IP of the ISR = 3405H

CS of the ISR = 2000H

Physical Address = CSX10H+IP = 2000X10+3405 = 23405H   **(Answer)**

Example: Determine the physical address of the ISR for the given IVT if Type 255 interrupt is encountered by 8086 microprocessor.

CS : IP	Physical Address	Memory
0000 : 0000	00000	05H
0000 : 0001	00001	34H
0000 : 0002	00002	00H
0000 : 0003	00003	20H
....	....	....
....	....	....
....	....	....
0000 : 03FC	003FC	22H
0000 : 03FD	003FD	33H
0000 : 03FE	003FE	00H
0000 : 03FF	003FF	40H

Solution:

Type 255, N = 255

IP = 4N = 4X255 = 1020D = 003FCH (Address of the ISR IP)

IP is stored at this address. This is not the value of the IP, it is the value at which the IP of the ISR will be located.

CS = 4N+2 = 4X0+2 = 1022D = 003FEH (Address of the ISR CS)

IP of the ISR = 3322H

CS of the ISR = 4000H

Physical Address = CSX10H+IP = 3322X10+4000 = 43322H **(Answer)**

Dedicated Interrupts (5) – Type 0 to Type 4 – They also called as predefined interrupts.

Reserved Interrupts (27) – Type 5 to Type 31 – Reserved by Intel for use in its future level of processors.

Available Interrupts (224) – Type 32 to Type 255 – Available to the user to be used as hardware or software interrupts.

Whether it is an external (h/w) or an internal (s/w) interrupt mapped to Type number (N)

The starting addresses of different types of interrupts are – (Range of different categories)

Interrupt Type	Starting Address	Interrupt Type	Starting Address
Type 0	00000H	Type 32	00080H
Type 1	00004H	Type 33	00084H
Type 2	00008H	Type 34	00088H
Type 3	0000CH	Type 35	0008CH
Type 4	00010H	....	....
Type 5	00014H	....	....
Type 6	00018H	....	....
....	....	Type 252	003F0H
Type 29		Type 253	003F4H
Type 30	00078H	Type 254	003F8H
Type 31	0007CH	Type 255	003FCH